

FOUR-PHASE DUAL PUMPING CIRCUIT

Abstract

A four-phase dual pumping circuit has a number of stages according to the required output voltage based on an input voltage. Each stage has a first pumping unit and a second pumping unit that are mirror and identical to each other and electrically coupled to each other. The dual pumping circuit is controlled by four-phase clocks which are made from one pair of out of phase clocks. The transistors of the dual pumping circuit have special substrate connection to minimize body effects. The four-phase dual pumping circuit uses NMOSFETS for negative pumping and PMOSFETS for positive pumping.